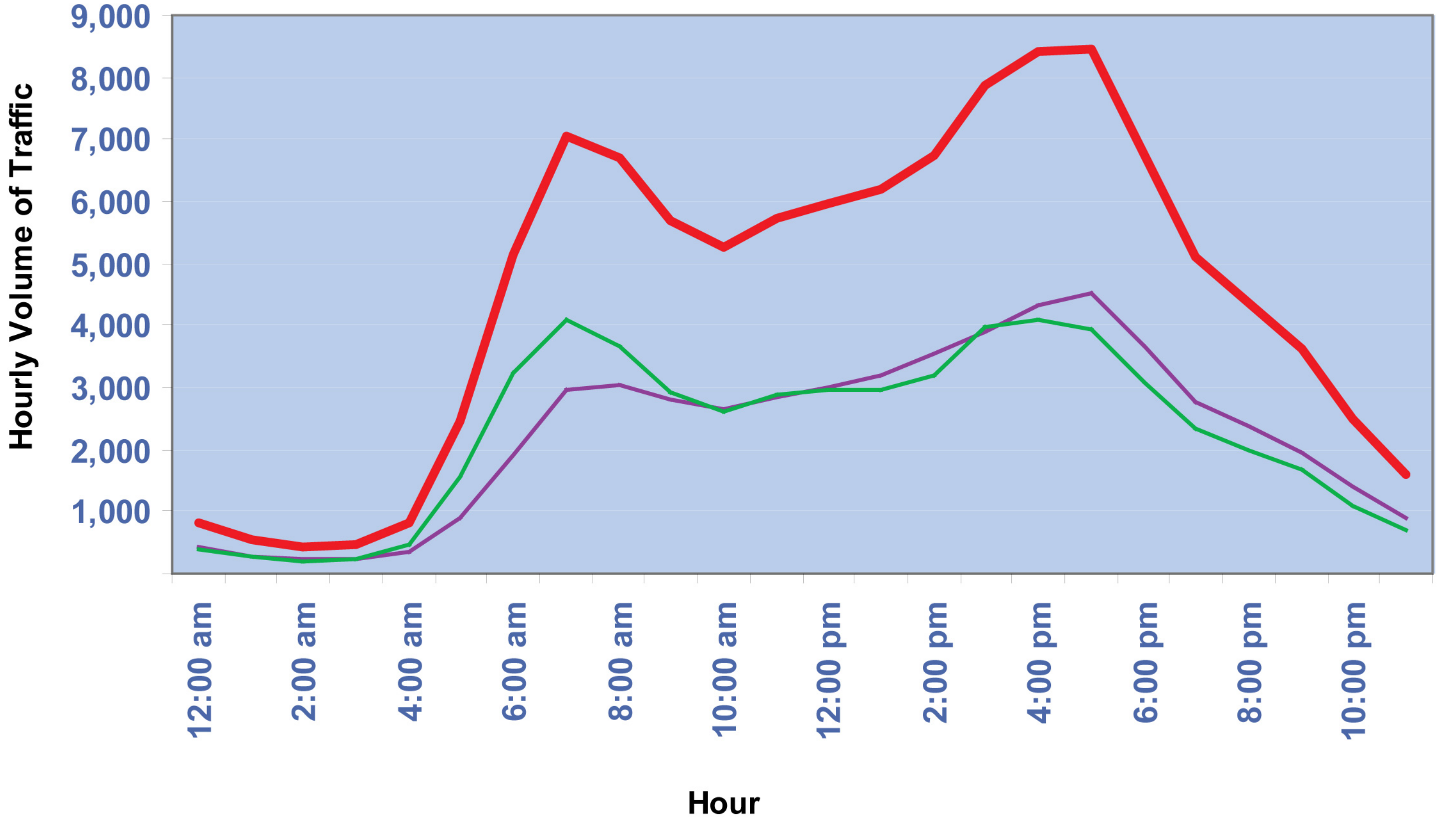


Figure 1-9

I-15 Traffic Volumes by Time of Day

LEGEND: Northbound Traffic; Southbound Traffic; Total

Data Source: Automatic Traffic Recorder (ATR) located between University Parkway and Provo Center Street, 2005

Table 1-3: 2005 Average Daily and Peak Hour I-15 Traffic Volumes

I-15 Mainline Section	Average Daily Traffic (Both Directions)	Southbound PM Peak Hour Traffic (vph*)	Northbound Peak Hour Traffic (vph*)
South Utah County			
South Payson to North Payson	34,600	1,350 (PM)	1,460 (AM)
North Payson to SR-164 Benjamin	45,400	2,100 (PM)	1,880 (AM)
SR-164 Benjamin to Spanish Fork Main St.	45,500	2,140 (PM)	1,810 (AM)
Spanish Fork Main St. to US-6	58,700	2,830 (PM)	2,810 (AM)
US-6 to South Springville	75,700	4,130 (PM)	3,910 (AM)
South Springville to North Springville	88,900	4,810 (PM)	4,500 (AM)
Central Utah County			
North Springville to University Ave.	98,100	5,040 (PM)	5,070 (AM)
University Ave. to Provo Center St.	85,400	3,830 (PM)	4,140 (AM)
Provo Center St. to University Pkwy	99,800	4,510 (PM)	4,090 (PM)
University Pkwy to Orem Center St.	120,300	5,020 (PM)	4,710 (PM)
Orem Center St. to Orem 800 North	126,800	4,950 (PM)	5,140 (PM)
Orem 800 North to Orem 1600 North	133,900	5,110 (PM)	5,340 (PM)
North Utah County			
Orem 1600 North to Pleasant Grove	132,200	4,960 (PM)	5,550 (PM)
Pleasant Grove to American Fork 500 East	129,300	4,580 (PM)	5,760 (PM)
American Fork 500 East to American Fork Main St.	121,400	4,660 (PM)	5,780 (PM)
American Fork Main St. to Lehi Main St.	117,400	4,670 (PM)	5,550 (PM)
Lehi Main St. to Lehi 1200 West	105,500	4,600 (PM)	4,660 (PM)
Lehi 1200 West to Alpine	112,700	5,520 (PM)	5,800 (AM)
South Salt Lake County			
Alpine to Bluffdale	123,600	6,360 (PM)	6,290 (AM)
Bluffdale to Bangerter Highway	129,400	6,740 (PM)	7,210 (AM)
Bangerter Highway to 12300 South	138,600	7,980 (PM)	8,030 (AM)

** vph = vehicles per hour*

1.8.3 Existing Mainline Traffic Operations

Mainline traffic performance was evaluated using criteria described in the *Highway Capacity Manual (HCM)*[5]. Data from the HCM was used to develop an estimated capacity for one-way general purpose lane traffic volumes for 2-, 3-, 4-, and 5-lane freeways. Table 1-4 summarizes the maximum hourly one-way traffic volumes for each LOS.

The 2005 peak hour volumes shown in Table 1-3 were compared to the LOS values in Table 1-4 to equate traffic volumes to LOS. To account for the increased capacity due to express lanes and auxiliary lanes, the peak hour volumes were reduced by 800 vehicles in the appropriate locations. This reduction was based on empirical data collected on the usage of existing express lanes in Utah and Salt Lake counties.

Table 1-4: Peak Hour Level-of-Service Criteria for One-Way General Purpose Lane Volumes (vehicles per hour)

LOS	2-Lane Freeway (vph)	3- Lane Freeway (vph)	4-Lane Freeway (vph)	5- Lane Freeway (vph)
A	1,230	1,900	2,590	3,320
B	2,030	3,110	4,250	5,430
C	2,930	4,500	6,130	7,820
D	3,840	5,850	7,930	10,070
E	4,560	6,930	9,360	11,850
F	> 4,560	> 6,930	> 9,360	> 11,850

Sources: Highway Capacity Manual 2000*, Exhibit 13-6, page 13.*

Figure 1-2 shows the resulting 2005 freeway Levels of Service. As shown in the figure, almost all of the mainline segments are operating at LOS D or better. The only exception is the northbound segment from Bluffdale to Bangerter, which is operating at LOS E.

1.8.4 Existing Intersection Operations

The operation of the I-15 mainline can be impacted by traffic conditions on the interchange ramps leading onto, and exiting from I-15. The intersections of the I-15 ramps with cross-streets also impact the traffic operations of these cross-streets as they approach I-15, potentially affecting the access from adjacent communities to I-15.

LOS for intersections is based upon the delay experienced by vehicles at the intersection. For signalized intersections delay per vehicle is calculated for the entire intersection. At unsignalized intersections delay is calculated for the approach with the highest delay. Intersection traffic performance was modeled using the Synchro traffic analysis software, a computer program designed for development of signal timing plans and analysis of intersection traffic operations.

1.8.4.1 Intersection Operations in South Utah County

Most of the existing signalized intersections in south Utah County operate at LOS D or better (see Figure 1-3). However, at the South Payson interchange, the intersection of the southbound (SB) I-15 ramps and 800 South are operating at LOS F. In addition, at the South Springville interchange, the intersections of the I-15 SB ramps and the I-15 northbound (NB) ramps with SR 77 operate at LOS E and LOS F, respectively. Each of the intersections that operates unacceptably is unsignalized.

[5] Transportation Research Board National Research Council, *Highway Capacity Manual*, 2000

1.8.4.2 Intersection Operations in Central Utah County

PM peak hour LOS for existing intersections in Central Utah County are shown in Figure 1-4, which indicates that most of the intersections are operating at LOS D or better. However, at the I-15 University Parkway interchange, the intersections at the I-15 ramps and Sandhill Road both operate at LOS E. At the Orem Center Street interchange, both the northbound and southbound ramps operate at LOS F. At the 800 North Orem interchange, the I-15 northbound ramps are operating at LOS F.

1.8.4.3 Intersection Operations in North Utah County

The existing LOS results for North Utah County shown in Figure 1-5 indicate intersections at several interchanges are at LOS E or F. At the American Fork 500 East interchange, the I-15 northbound ramps at American Fork 500 East are at LOS F during the PM peak hour. In addition, both northbound and southbound I-15 ramps at the American Fork Main Street interchange operates at LOS F. In addition, at the Lehi Main Street interchange, the I-15 southbound ramp at Lehi Main Street operates at LOS F. At the Lehi 1200 West interchange, both the I-15 southbound off-ramp at 2100 North, and the I-15 northbound ramps at 1200 West operate at LOS F.

1.8.4.4 Intersection Operations in South Salt Lake County

The existing LOS results for South Salt Lake County shown in Figure 1-6 indicate that most of the intersections operate at reasonable levels of service (i.e., LOS D or better) during the PM peak hour. However, at the Bluffdale interchange, the unsignalized intersections of Pony Express Road and 14600 South and the I-15 northbound ramps are operating at LOS F.

1.9 Regional and Intra-County Role of I-15

I-15 operates as part of a regional transportation network. I-15 also serves as the only continuous north-south highway for local travel within Utah County and is used extensively for local trips. Although other north-south arterial roadways such as Redwood Road, Geneva Road and State Street are used for local north-south trips in Utah County, of these, only Redwood Road connects Utah and Salt Lake counties.

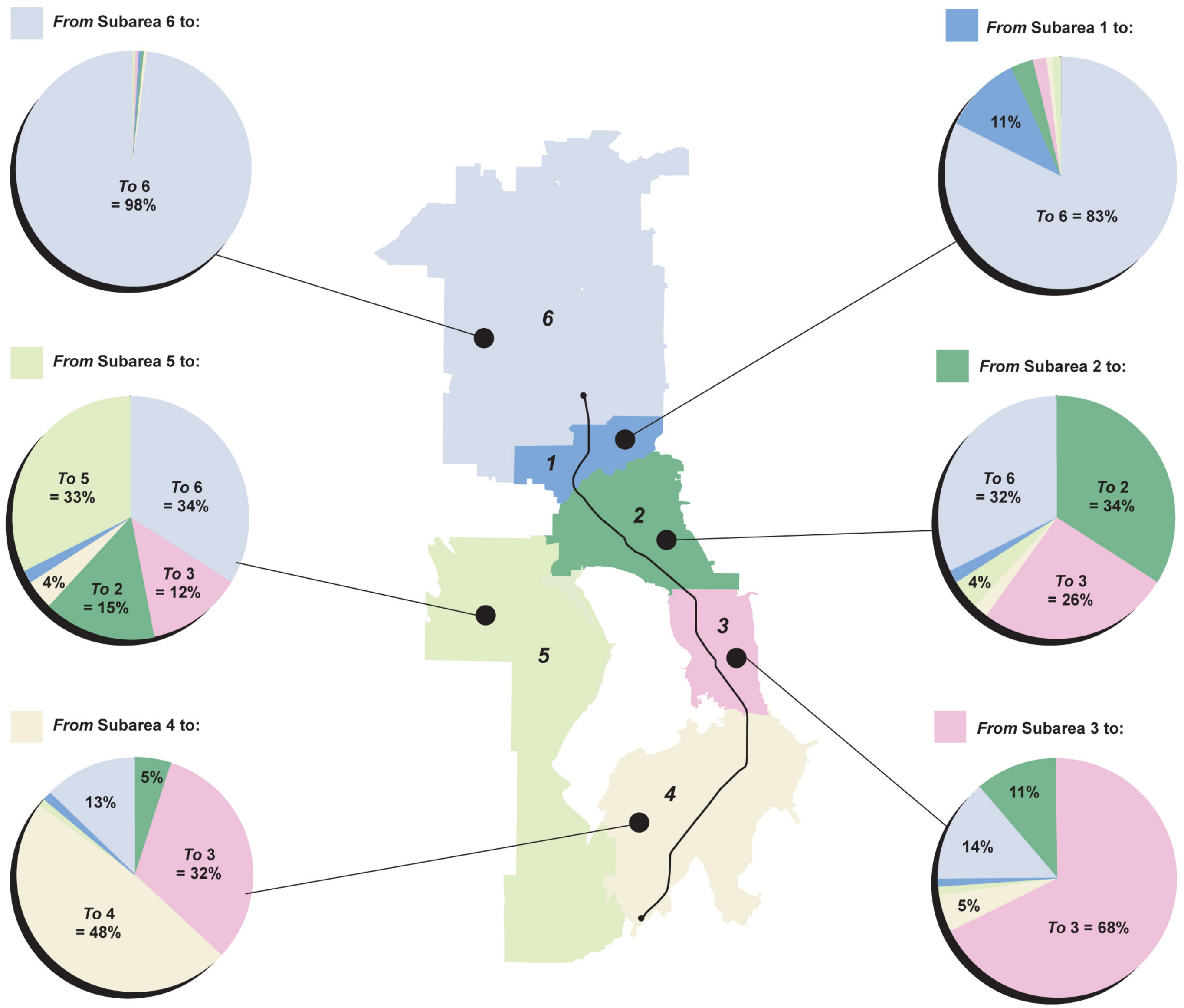
One aspect of I-15 is the role that it plays accommodating trips within Utah and Salt Lake counties and between the two counties. This was assessed by examining two types of person trip patterns – year 2030 daily home-based work person trips and total daily person trips for six geographic subareas within Utah and Salt Lake County: South Salt Lake County, North Utah County, Central Utah County, South Utah County, West Utah County, and North and Central Salt Lake County.

Home-based work person trips, generally commuters traveling between home and work, are concentrated in the morning and evening peak periods when transportation facilities are most heavily congested. Figure 1-10 summarizes this analysis.

Within South Utah County, 48% of work trips stay within South Utah County. In Central Utah County (including Provo and Orem), 68% of trips stay within that geographic area. About one-third of trips in North Utah County stay within that geographic area. These figures indicate that I-15 in Utah County will continue to play an important role in local circulation within the County. As over 80% of work trips from South Salt Lake County are destined to North and Central Salt Lake County, I-15 in this area plays an important regional role.

In addition, this analysis shows that there are two primary destinations that need to be served by I-15:

- Central Utah County, including Provo and Orem, with about 39 percent of all trips coming from all areas within the metropolitan area; and
- Salt Lake County, receiving about 28 percent of the trips.



Please Note: Percentages of 3 or less are not labeled.

Figure 1-10

2030 Home Based Work Daily Person Trips

LEGEND

- I-15 Mainline inside Study Corridor
- West Utah County (Subarea 5)
- South Utah County (Subarea 4)
- Central Utah County (Subarea 3)
- North Utah County (Subarea 2)
- South Salt Lake County (Subarea 1)
- North and Central Salt Lake County (Subarea 6)

N

Source: Travel forecasts prepared by Parsons Brinckerhoff in 2004 using the WFRC/MAG regional travel model.

1.10 Future Travel Demand and Traffic

The operations of the I-15 mainline and the operations of the intersections of the I-15 ramps and cross-streets at the existing interchanges were analyzed. The development of predicted travel demand for the year 2030 was undertaken to provide volumes. As defined in the Chapter 2 Alternatives Considered, this condition is referred to as the 2030 No Build, and is the basis against which alternatives are compared. The process incorporates output from regional travel demand forecasting models and subsequent development of volumes. It assumes all roadway and transit improvements recommended in the 2030 regional transportation plans, other than I-15 reconstruction, have been implemented.

1.10.1 Regional Travel Demand Forecasting Modeling

Traffic forecasts for year 2030 conditions are based on growth projected by WFRC and MAG regional travel demand forecasting model. The travel model predicts future travel demand based on land use, socioeconomic, and transportation system characteristics. A single model is maintained for a four-county region by both metropolitan planning organizations (MPO) with each MPO responsible for inputs associated with their area. The model itself is a complex system of several models that are written in the TP+ scripting language.

Specific inputs to the regional model are socioeconomic data and transportation system data. The socioeconomic data includes population, households, employment, and average household income. Household data is further classified by household size (1 person to 6+ persons), number of workers (0 to 3+), and income quartiles. Employment data is further classified as retail, industrial, or other. The transportation system data includes both roadway and transit networks. The roadway networks include freeways, arterials, and some collector streets. The transit networks include commuter rail and light rail lines, bus rapid transit lines, express bus lines, and most local bus lines.

Existing socioeconomic and transportation system data are gathered for use in creating a base year model. The base year model is calibrated to observed data such as roadway volumes and speeds and transit ridership. Future year forecasts are prepared by running the calibrated model using future year socioeconomic and transportation system data.

Future year socioeconomic data is prepared by the MPOs in conjunction with the Governor's Office of Planning and Budget (GOPB). The GOPB prepares county level population and employment totals. The MPOs then work with the cities to divide the population to city-level totals. Finally, the population and employment data are further divided among each Traffic Analysis Zone (TAZ). The individual TAZs are the blocks that comprise the model. Approximately 1,300 TAZs are used in the WFRC/MAG regional model. Initial future transportation network data is prepared by each MPO based on the Regional Transportation Plans (formerly known as Long Range Transportation Plans) of each organization.

The WFRC/MAG model is based on the typical four-step modeling process: trip generation, trip distribution, mode split, and trip assignment. The WFRC/MAG model adds an auto ownership model to better refine trip generation and mode choice. The model has a feedback loop between trip distribution and traffic assignment which allows traffic congestion to influence trip distribution patterns.

Following the estimation of travel demand (defined as numbers of trips between specified origins and destinations, by mode and by time of day) a final set of models are used to assign these trips to highway and transit networks. The MPOs have continually updated the model over the last several years to incorporate new observed data and increased capabilities. Model version 4.2 was used at the beginning of the I-15 Corridor EIS to develop the purpose and need and for the screening of alternatives, version 5.0[6] was used for alternatives refinement and the final DEIS

[6] The regional MPOs updated from version 4.2 to version 6.0 during the course of this FEIS.

forecasts, and version 6.0 was used for the FEIS. The model is used to generate future traffic projections, which inform aspects of roadway design, and to evaluate impacts to some aspects of the natural environment, including Air Quality and Noise.

1.10.2 Year 2030 Volume Development

Estimated 2030 PM peak hour volumes were developed from existing traffic counts and forecast volumes from the WFRC/MAG regional travel demand forecasting model (WFRC/MAG model) using principles described in the National Cooperative Highway Research Program Report 255 published by the Transportation Research Board. The existing (2005) PM peak hour turning movement volumes were the basis for the development of future volumes. Using the WFRC/MAG model a comparison was made between 2030 and base year (2001) volumes, factoring for the difference between the base year (2001) and the existing data year (2005). The result of this comparison was applied to the existing data to obtain future volumes entering and exiting the intersection. An iterative procedure was then utilized to adjust the existing turning movement volumes to match the projected future total intersection volumes. This methodology was employed to determine intersection volumes for each study intersection and also resulted in ramp volumes for each interchange.

Using these ramp volumes and the Point of the Mountain as a reference point with a starting volume taken directly from the WFRC/MAG model, the ramp volumes were added or subtracted from the mainline volumes along the length of the entire corridor. The resulting mainline volumes were compared to the WFRC/MAG model volumes and the reference point volume adjusted until the relative difference between the two was eliminated when calculated along the length of the corridor. This gave volumes that were generally within 10% of the WFRC/MAG model volumes for the majority of the corridor. Table 1-5 shows the estimated No-Build 2030 daily and peak hour volumes.

1.10.3 Year 2030 Mainline Traffic Operations

Year 2030 mainline traffic performance was evaluated using the same methodology as the existing conditions analysis. The peak hour traffic volumes shown in Table 1-5 were compared to the LOS values in Table 1-4 to equate traffic volumes to LOS. To account for the increased capacity due to express lanes the peak hour volumes were reduced by 1,680; while the peak hour volumes were reduced by 800 to account for auxiliary lanes. This reduction was based on the assumption that the express lanes would be managed in such a manner that they operate at LOS C, which occurs at volumes up to 1,680 vehicles per hour.

The operation of I-15 in 2030 is shown in Figure 1-2. As illustrated, most of the corridor north of the North Payson interchange (Exit 250) is expected to operate unacceptably at LOS E or F.

1.10.4 Year 2030 Intersection Operations

Year 2030 intersection traffic performance was analyzed using the same methodology as the existing conditions analysis. The Synchro software was used to obtain intersection delays and corresponding levels of service for signalized and unsignalized intersections.

1.10.4.1 2030 Intersection Operations in South Utah County

Figure 1-3 shows the 2030 PM peak hour intersection Levels of Service for South Utah County. Nearly all of the intersections will operate at LOS E or F. All ramps and intersections at the South Payson, North Payson, SR-164 Benjamin, and South Springville interchanges will be operating at LOS F. At the Spanish Fork Main Street interchange, the northbound ramps will be operating at LOS F.

Table 1-5: Year 2030 No-Build I-15 Average Daily and Peak Hour Traffic Volumes

I-15 Mainline Section	Average Daily Traffic (Both Directions)	Southbound PM Peak Hour Traffic (vph*)	Northbound Peak Hour Traffic (vph*)
South Utah County			
South Payson to North Payson	60,300	3,470 (PM)	3,660 (AM)
North Payson to SR-164 Benjamin	76,900	4,200 (PM)	3,880 (AM)
SR-164 Benjamin to Spanish Fork Main St.	87,600	4,460 (PM)	3,980 (AM)
Spanish Fork Main St. to US-6	95,300	5,170 (PM)	4,970 (AM)
US-6 to South Springville	128,500	6,640 (PM)	6,470 (AM)
South Springville to North Springville	155,200	7,560 (PM)	6,900 (AM)
Central Utah County			
North Springville to University Ave.	169,300	7,910 (PM)	7,380 (AM)
University Ave. to Provo Center St.	133,400	6,360 (PM)	6,270 (AM)
Provo Center St. to University Pkwy	157,400	6,890 (PM)	6,190 (PM)
University Pkwy to Orem Center St.	167,900	8,000 (PM)	7,960 (PM)
Orem Center St. to Orem 800 North	186,400	8,010 (PM)	7,340 (PM)
Orem 800 North to Orem 1600 North	194,000	8,130 (PM)	7,420 (PM)
North Utah County			
Orem 1600 North to Pleasant Grove	195,600	7,780 (PM)	7,440 (PM)
Pleasant Grove to American Fork 500 East	196,400	7,470 (PM)	7,510 (PM)
American Fork 500 East to American Fork Main St.	195,000	8,070 (PM)	8,170 (PM)
American Fork Main St. to Lehi Main St.	201,600	8,310 (PM)	8,430 (PM)
Lehi Main St. to Proposed MVC/Lehi 1200 West	204,100	8,350 (PM)	7,900 (PM)
Proposed MVC/Lehi 1200 West to Alpine	185,200	7,520 (PM)	7,270 (AM)
South Salt Lake County			
Alpine to Bluffdale	228,100	9,480 (PM)	8,460 (AM)
Bluffdale to Bangerter Highway	225,900	9,590 (PM)	9,210 (AM)
Bangerter Highway to 12300 South	260,400	12,190 (PM)	11,980 (AM)

1.10.4.2 2030 Intersection Operations in Central Utah County

Year 2030 PM peak hour intersection Levels of Service for Central Utah County are shown in Figure 1-4. Most of the signalized intersections will operate at LOS E or F. All of the ramp intersections will be at LOS F with the exception of the University Avenue interchange, which will operate at LOS B. The only other intersections that will operate acceptably are the intersections of Provo Center Street with 1600 West and 900 West.

1.10.4.3 2030 Intersection Operations in North Utah County

Figure 1-5 indicates that in the 2030 PM peak hour most of the North Utah County intersections will be operating at LOS E or F. At all interchanges in this section, intersections at both the northbound and southbound I-15 ramps will be operating at LOS F or LOS E with the exception of the northbound ramps at the Lehi Main Street interchange, which will operate at LOS C at the northbound ramps. In addition, at the American Fork Main Street interchange, the intersection of US-89 and American Fork Main Street will be operating at LOS F.

1.10.4.4 2030 Intersection Operations in South Salt Lake County

Figure 1-6 shows the 2030 PM peak hour intersection Levels of Service for South Salt Lake County. The north and southbound ramp intersections at the Bluffdale interchange will both operate at LOS F. The other intersections will operate acceptably (LOS D or better). The Bangerter Highway interchange is expected to operate at LOS C because the 2007 WFRC Regional Transportation Plan includes a partial conversion of Bangerter Highway to a freeway facility with system ramps at I-15. These system ramps will carry approximately 70% of the interchange traffic, leaving 30% to utilize the SPUI intersection.

1.11 Safety and Crash Analysis

Crash rate and average severity are two measures used to evaluate the crash history for a segment of roadway. The crash rate shows how many crashes are occurring, while the average severity indicates the level of damage caused in the average crash. These values are compared to statewide averages for similar type facilities. Another factor considered when evaluating crashes is the type of crash that is occurring. A predominance of crashes of one type is often an indicator of specific problems.

The crash rate is expressed as the number of crashes occurring per million vehicle miles traveled (VMT) on a roadway segment. For example, if a two-mile segment of freeway has an average daily traffic volume of 100,000 vehicles per day, this segment has 200,000 miles of vehicle travel per day for an annual total of 73 million VMT. Over three years, it has 219 million VMT. If there were 329 crashes on this segment in three years, then the resulting crash rate would be 1.50 crashes per million vehicle miles traveled (i.e. 329 crashes divided by 219 million VMT). Therefore, the higher the crash rate, the more total crashes there are on a roadway segment over a period of time.

Crash severity rating is a measurement of the damage caused by each crash. The Utah Highway Patrol assigns a severity rating to each crash on their report form. The severities range from 1 to 5 on the following list:

1. No Injury;
2. Possible Injury;
3. Bruises & Abrasions;
4. Broken Bones or Bleeding Wounds; and
5. Fatality

The severity rating is calculated based on the average of all crash severity ratings for a particular roadway segment. For example, a segment with a crash severity of 1.5 means that the average crash on that roadway is midway between one with no injury and one with a possible injury.

The statewide average crash rate and severity rating are developed by UDOT by averaging crashes on similar facilities over a five-year time period. Similar facilities are classified by functional classification[7] (e.g. freeway), daily roadway volume, and area type (e.g. urban, rural). Each year UDOT creates an expected values report representing the previous five years' crash rates and average severity ratings for various roadways, functional classifications, and daily volumes. For example, an urban freeway with a daily volume of 100,000 vehicles per day has an average crash rate of 1.57 crashes per million vehicle miles and an average severity of 1.42. The analysis within this EIS is based on UDOT's 2003 expected values report.

Table 1-6 lists the total number of crashes by I-15 location and the types of crashes. Table 1-7 compares the crash rate and severity rating to the statewide average for a similar facility. The variation in average rates among segments is due to volume differences along the corridor. In general, when the volume is less than 100,000 there is a different average rate for every 5,000 vehicles per day. When the volume is over 100,000 a new average rate is used every 50,000 vehicles per day.

If a section of roadway is near or over the statewide average, the crash rate is typically a factor considered by UDOT in determining priorities for implementing transportation improvement projects. Crash types, and the recurrence of each type, factor into the safety improvements necessary to lower the overall crash rate.

The crash severity rate exceeds the statewide average severity rate in eleven out of the fourteen crash analysis segments shown in Table 1-7. None of the segments exceed the average crash rate, although the segments with the highest crash rates are Bangerter Highway to 12300 South and in the general S-curve area. Figure 1-11 shows the areas in the corridor with higher than average crash severities.

[7] Functional classification defines streets and roads according to the type of service they are intended to provide. AASHTO's *A Policy on Geometric Design of Highways and Streets, 2004* provides guidance on functional classification.

Table 1-6: Crash Severity Type by Segment*

From	To	No Injury (1)	Possible Injury (2)	Bruises & Abrasions (3)	Broken Bones or Bleeding Wounds (4)	Fatality (5)	Total Number of Crashes	Percent of all Crashes[1]
South Payson	North Payson	60	20	7	10	3	100	2.5%
North Payson	Spanish Fork Main Street	88	30	16	21	2	157	3.9%
Spanish Fork Main Street	South Springville	150	44	13	16	0	223	5.5%
South Springville	University Avenue	186	56	18	15	2	277	6.9%
University Avenue	S-Curve[2]	286	98	38	28	3	453	11.2%
S-Curve	S-Curve	64	19	11	10	1	105	2.6%
S-Curve	University Parkway	79	29	9	9	2	128	3.2%
University Parkway	Orem 800 North	179	74	22	15	2	292	7.2%
Orem 800 North	Pleasant Grove	113	46	16	5	1	181	4.5%
Pleasant Grove	American Fork	212	89	28	29	5	363	9.0%
American Fork	Lehi 1200 West	102	33	12	11	2	160	4.0%
Lehi 1200 West	Alpine	163	45	18	12	1	239	5.9%
Alpine	Bangerter Highway	587	126	34	33	6	786	19.5%
Bangerter Highway	12300 South	410	126	24	12	1	573	14.2%
Total Crashes by Type[3]		2,679	835	266	226	31	4,037	
Percent of Crashes		66.4%	20.7%	6.6%	5.6%	0.8%		

* Three-year period between 2001 and 2003

[1] Percent of total crashes between South Payson and 12300 South interchange by segment
[2] S-curve is a one-mile segment between University Parkway and Provo Center Street.
[3] Total number of crashes between South Payson and 12300 South by type

Table 1-7: Crash Analysis for I-15 EIS Corridor

From	To	Crash Rate[1]	Statewide Average Crash Rate	Crash Severity	Statewide Average Crash Severity	Primary Type	Secondary Type
South Payson	North Payson	0.82	2.52	1.76	1.74	Single Vehicle	Rear-end
North Payson	Spanish Fork Main Street	0.82	1.29	1.85	1.43	Single Vehicle	Rear-end
Spanish Fork Main Street	South Springville	0.75	1.58	1.53	1.50	Rear-end	Single Vehicle
South Springville	University Avenue	0.88	1.17	1.52	1.55	Single Vehicle	Rear-end
University Avenue	S-Curve[2]	1.15	1.17	1.60	1.55	Rear-end	Single Vehicle
S-Curve	S-Curve	1.14	1.29	1.71	1.55	Rear-end	Single Vehicle
S-Curve	University Parkway	1.14	1.29	1.64	1.55	Rear-end	Side-swipe
University Parkway	Orem 800 North	0.99	1.83	1.59	1.45	Rear-end	Single Vehicle
Orem 800 North	Pleasant Grove	0.82	1.83	1.54	1.45	Rear-end	Single Vehicle
Pleasant Grove	American Fork Main Street	0.76	1.83	1.69	1.45	Single Vehicle	Rear-end
American Fork Main Street	Lehi 1200 West	0.56	1.83	1.61	1.45	Single Vehicle	Rear-end
Lehi 1200 West	Alpine	0.61	1.83	1.51	1.45	Single Vehicle	Rear-end
Alpine	Bangerter Highway	1.09	1.83	1.40	1.45	Rear-end	Single Vehicle
Bangerter Highway	12300 South	1.58	1.83	1.37	1.45	Rear-end	Single Vehicle

Source: UDOT Crash Data, UDOT Traffic and Safety Division

LEGEND: RED: Crash Severity exceeds statewide average

[1] Per million vehicle miles of travel
[2] S-curve is a one-mile segment between University Parkway and Provo Center Street.

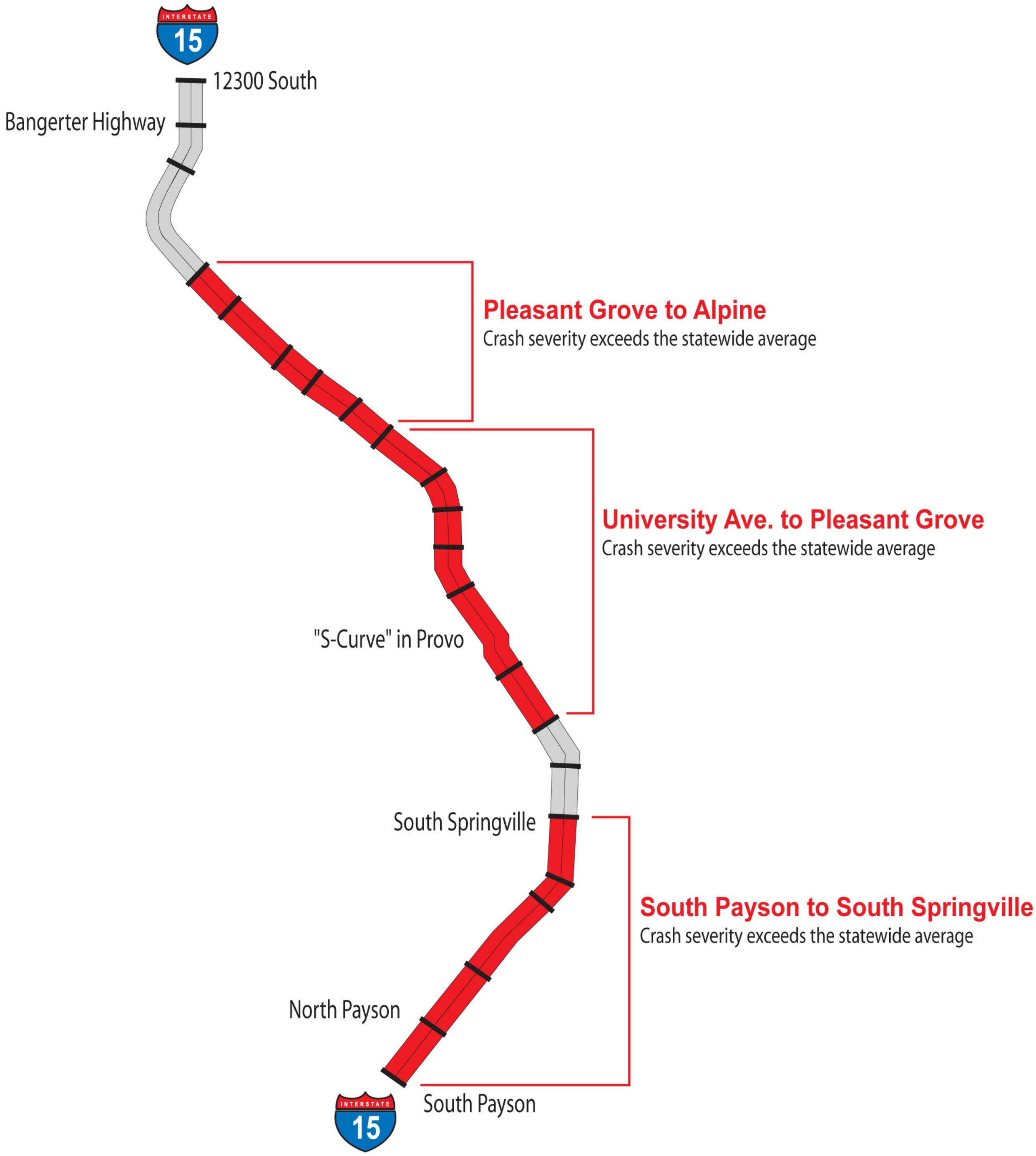


Figure 1-11
I-15 Safety Issues / Areas of Concern

1.12 Substandard Roadway Features

An analysis of the horizontal and vertical alignments of I-15 identified several substandard roadway geometric features that contribute to congestion and safety problems. The definition of substandard roadway geometry is based upon the highway design standards established by the American Association of State Highway and Transportation Officials (AASHTO). Roadway geometry includes the horizontal alignment (how the roadway curves left and right) and vertical alignment (changes in grade or how the roadway curves up and down) and their impact on stopping sight distance. Stopping sight distance is the distance that it takes for a driver to see an obstruction and safely stop their vehicle without hitting the object. AASHTO requires that drivers have an unobstructed view down the roadway that is at least as long as the stopping sight distance.

Figure 1-12 illustrates locations where the current I-15 roadway geometry does not meet AASHTO design guidance.

1.12.1 On-Ramp Acceleration Length

The ability of a vehicle entering I-15 to accelerate to freeway speeds to merge into oncoming traffic is a function of the length and grade of the on-ramp. Using aerial photography, the available acceleration length was measured for all on-ramps for I-15 interchanges in the corridor. This length was compared with the recommended minimum acceleration length listed in Exhibit 10-70 in the 2004 AASHTO design guide[8]. Two ramps were found to have inadequate acceleration length: the southbound on-ramp at the Lehi 1200 West interchange and the southbound on-ramp for the Lehi Main Street interchange. The Lehi 1200 West on-ramp has approximately 1,175 feet of available acceleration length; while the Lehi Main Street on-ramp has approximately 1,250 feet of available acceleration length. AASHTO recommends 1,310 feet to accelerate from 20 to 65 mph.

1.12.2 Mainline Horizontal Curvature

Using aerial mapping, the centerline radii of the I-15 mainline horizontal curves were measured. For I-15's design speed of 70 mph[9], AASHTO recommends a minimum centerline radius of 2,040 feet[10]. Two curves in the corridor are substandard. These are reverse curves known as the S-curve between the University Parkway and Provo Center Street interchanges. The northern-most curve has an approximate radius of 1,750 feet. The southern curve has an approximate radius of 1,620 feet.

[8] AASHTO's *A Policy on Geometric Design of Highways and Streets, 2004*, page 847
[9] AASHTO's *A Policy on Geometric Design of Highways and Streets, 2004*, page 503
[10] AASHTO's *A Policy on Geometric Design of Highways and Streets, 2004*, page 169

Figure 1-12
Substandard Roadway Features

I-15 Mainline inside Study Corridor

I-15 Interchanges inside Study Corridor

H Substandard Horizontal Curve

V Substandard Vertical Curve

ACC Substandard Acceleration Length at On-Ramps

Direction of Ramp

N

1.12.3 Vertical Sight Distance

According to AASHTO guidance, the required stopping sight distance for a highway with a design speed of 70 mph is 730 feet.[11] There are 15 vertical curves in the existing I-15 mainline that do not meet this stopping sight distance standard. Of these 15 vertical curves, 11 are crest curves (an upgrade followed by a downgrade) and four are sag curves (a downgrade followed by an upgrade). The substandard vertical curves are at the following approximate locations:

- Three crest curves between the North Payson and South Payson Interchanges
- Two sag curves and one crest curve between the North Payson and SR-164 Benjamin Interchanges
- One sag and one crest curve between the SR-164 Benjamin and Spanish Fork Main Street Interchanges
- Two crest curves between the US-6 and South Springville Interchanges
- One crest curve at the Provo Center Street Interchanges
- One crest curve between the American Fork 500 East and American Fork Main Street Interchanges
- One sag and two crest curves between the Lehi Main Street and Lehi 1200 West Interchanges

When a crest vertical curve is too short for the speed normally traveled on a highway, sight distance becomes limited. This can result in drivers cautiously braking as they negotiate the vertical curve since they cannot adequately see the road ahead, and causing vehicles behind them to brake and slow down. Another result of inadequate sight distance on a vertical curve can be a collision if an object lies in the driver's path.

From the perspective of stopping sight distance, headlight distance is the most important factor for determining sag vertical curve lengths. When a vehicle travels through a sag vertical curve at night, the portion of the highway illuminated ahead is dependent on the position of the headlights and the direction of the light beam. If the sag curve is too short for the speed normally traveled on a highway, then the headlights will not illuminate beyond the stopping sight distance length and the driver may brake causing vehicles behind him to slow down.

1.12.4 Structural Conditions

Structure Inventory and Appraisal (SI&A) sheets were obtained from the UDOT Structures Division for the 91 bridge structures from the 12300 South interchange to the South Payson interchange. The data in the SI&A sheets includes sufficiency ratings for the overall structure and condition ratings for the bridge deck, superstructure, and substructure. Other data includes the age of the structure and geometric data.

Evaluation of the SI&A sheets indicates that the 13 bridges shown in Table 1-8 have sufficiency ratings that indicate that repair of the substructure and/or superstructure and/or deck are warranted. Twelve of these bridges have sufficiency ratings of less than 80, which warrant repair and rehabilitation. Four of these structures have sufficiency ratings below 50, indicating that a total bridge replacement is warranted.

The vertical clearances of existing structures were reviewed to identify those that do not meet current standards. Fifty-nine structures in the study area do not meet current minimum vertical clearance standards, as found in AASHTO's *A Policy on Geometric Design of Highways and Streets* and UDOT's *Structures Design Manual*. UDOT standards require 16'-6" minimum vertical clearance over freeways and 23'-6" over railroads.

[11] AASHTO's *A Policy on Geometric Design of Highways and Streets, 2004*, page 112.

Table 1-8: Bridge Structure Sufficiency Ratings Warranting Repair or Replacement

Structure #	Location	Facility Carried	Sufficiency Rating
C-464-0	0.6 mile West of Spanish Fork	SR-147	65
F-111-0	South Springville Interchange	SR-77 Interchange Crossroad	71
F-676-0	700 West 920 South in Provo	I-15	80
C-360-1	Provo Center Street Interchange	SR-114 WB Ramp to I-15 NB	32
C-361-2	Provo Center Street Interchange	SB Ramp to SR-114 EB	39
C-364-2	Provo Center Street Interchange	SB Ramp to SR-114 EB	49
C-362-3	Provo Center Street Interchange	Ramp I-15 to SR-114 EB	49
C-363-3	Provo Center Street Interchange	I-15 SBL	76
C-358-1	1 mile North of Provo Interchange	I-15 NBL	64
C-357-1	1.1 miles North of Provo Interchange	I-15 NBL	62
C-348-0	South of American Fork	County Road (Sam White Lane)	76
C-347-0	American Fork 500 East Interchange	SR-180 Interchange Crossroad	76
C-343-3	US-89 (SR-89) & UPRR in Lehi	I-15 SBL	75

Source: UDOT Structures Division 2003-2007 Bridge Inspections

1.13 Conclusion

Several transportation-related needs were identified along the I-15 corridor in Utah and Salt Lake counties.

First, there is a need to avoid the unacceptable level of congestion which is projected to occur due to increased travel demand in the I-15 corridor. Based on projected growth in population and vehicle miles traveled, it is expected that by 2030, 15 of 21 mainline I-15 segments will exceed acceptable levels of service. Additionally, peak hour congestion will also exceed acceptable levels at one or more of the interchange components at 18 of the 22 interchanges on I-15 along the study corridor. Within the 22 interchanges, 40 of 61 components will have an unacceptable level of service. These 2030 projections assume that all other highway and transit projects in applicable regional transportation plans, including commuter rail and the Mountain View Corridor project, have been implemented. This need for transportation improvements in the I-15 corridor is recognized by regional and local transportation and land-use plans. These include the regional transportation plans maintained by the Wasatch Front Regional Council (WFRC) and Mountainland Association of Governments (MAG), which under federal law are responsible for transportation planning in the project area.

There is also a need to address substandard I-15 roadway features, which contribute to both congestion and safety concerns. Crash analysis of I-15 indicates that for 11 out of the 14 crash analysis segments in the project area, the crash severity rate exceeds the statewide average for similar roadways.

The first need for the Project – avoiding unacceptable congestion on I-15 – will be partially served by the commuter rail project that was previously being considered in this NEPA document but now is proceeding independently as a locally funded UTA project.

This project has a primary purpose and several secondary purposes. The primary purpose is to relieve 2030 peak-hour congestion within the I-15 corridor by improving LOS, on mainline I-15, on the existing 22 interchanges, and interchange components which provide access to and from local communities.

The secondary purposes or objectives of this project include achieving Level-of-Service (LOS) D on as many I-15 segments and interchanges as reasonably possible for the year 2030, as a measure of how effectively the project relives congestion; improving roadway safety by upgrading substandard roadway, bridge, and interchange elements to current American Association of State Highway Transportation Officials (AASHTO) and UDOT design standards; providing consistency with regional transportation plans prepared by MAG and WFRC; improving the regional and intra-county movement of people and goods; and providing a transportation system that is reasonably consistent with locally adopted land use and transportation plans and with the stated objectives of local governments and communities.

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